Gliricidia-based doubled up technology for improved crop production and agroecosystem resilience in Kongwa and Kiteto Districts

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Challenges and Study objective

- ✓ Extensive grazing and the use of crop residues for cooking energy are major drivers of land degradation in semiarid sites.
- ✓ Poor soil health and unreliable precipitations limit crop production and increase susceptibility to climate change
- ✓ Low use of inputs, especially mineral fertilizer, by farmers to sustain crop production

Main study objective

- To evaluate productivity and resilience effects of Gliricidia-based intercropping systems in semiarid Tanzania
- To test cropping arrangements/sequences that respond to farm sizes and agroecologies and as well as integrating farmer production objectives

Introduced technologies

(i) Gliricidia-maize intercropping

(ii) Gliricidia-maize-pigeonepea intercropping (Doubled up legume)

Evidence

- Intercropping maize with *G. sepium* and pigeonpea improved crops (maize and pigeonpea) yield by up to 33%, besides wood and fodder supply for improved livestock nutrition (Fig. 1).
- Intercropping at the appropriate proportions based on local site conditions optimizes crops yield and builds agroecosystem resilience as higher legume proportions (1:2 ratio of maize to pigeonpea) was more beneficial in a less potential site (Mlali) than a higher potential site (Chitego)(Table 1).
- Increased economic benefits of the doubled up technology compared to sole maize as noted by 3- and 4- folds increase in return to labour per day worked and gross margin, respectively (Table 2)
- Environmental benefits include improved soil fertility and organic carbon (45%), rainwater use efficiency (37%) and offsetting CO_2 emissions through on-farm wood supply (Kimaro et al., 2007; Kimaro et al., 2016)

Approaches of scaling the technologies

- Since 2014 the project has trained 151 contact farmers (52.5% Female) on tree seedling production and agroforestry technologies for semiarid sites.
- Agricultural shows, field days and other dissemination approaches has been used to out scale the technology to over 6,000 farmers (Fig. 2).
- Partnered with district council, extension officers and contact farmers to out scale the technology to Ngumbi and Kilosa.

Partners:

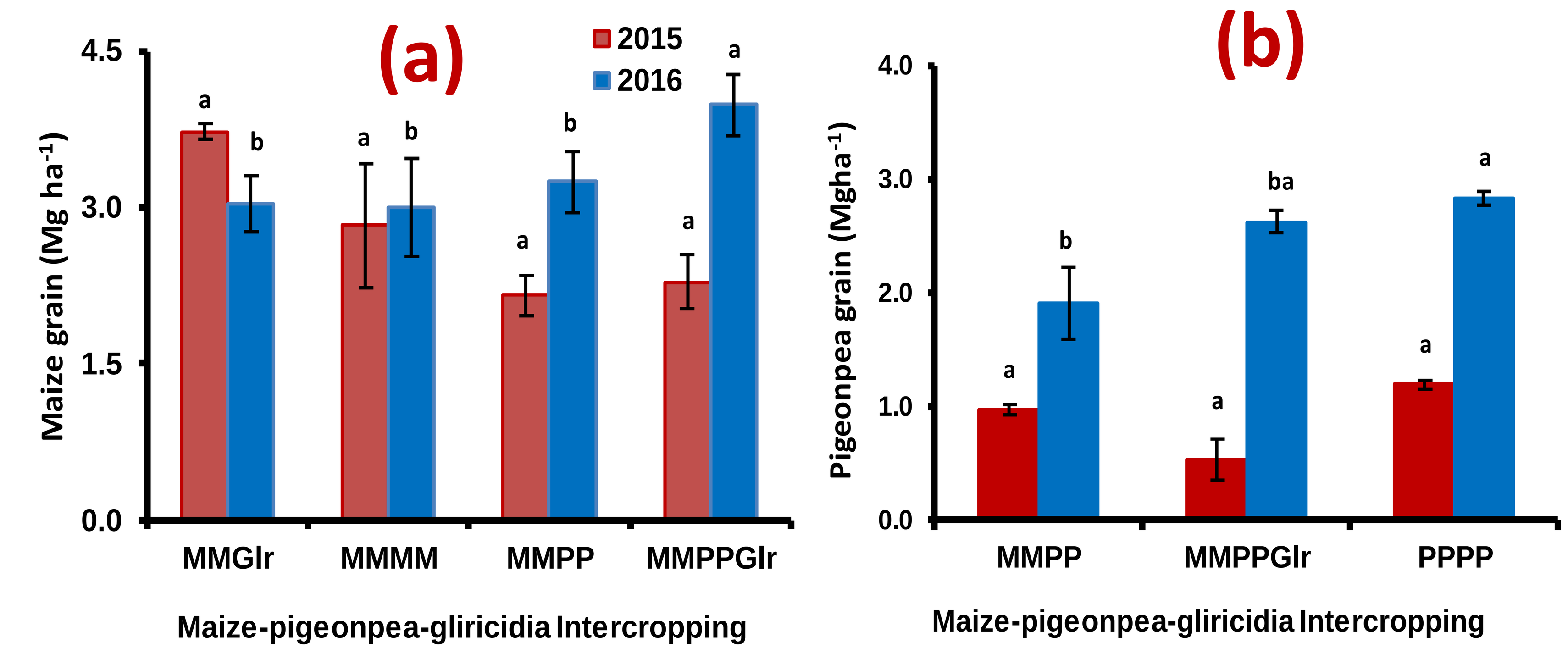

Fig. 1: Maize (a) and pigeonpea (b) grain yields in the Doubled up legume systems at Manyusi, Kongwa. MMGlr=Maize+Gliricida; MMMM=Maize monoculture, MMPP = Maize+Pigeonpea, MMPPGlr=Maize+Pigeonpea+Gliricidia, PPPP=Pure pigeonpea. Basal P was applied to all plots at planting at a rate of 15 kg P ha^{-1} using Minjingu (NAFAKA) fertilizer.

Table 1: LER for Maize(MM)-pigeonpea (PP) intercropping at Mlali and Chitego Villages, Tanzania (Kimaro et al. 2018, In press)

Maize-PP ratio	2015		2016	
	Mlali	Chitego	Mlali	Chitego
2M:1PP	1.13	1.56	1.21	1.17
1M:1PP	1.12	1.47	1.46	1.53
1M:2PP	1.32	1.15	1.54	1.28

Fig. 2: Improved crops growth in a doubled up legume at Mlali Village (a). The Vice President of Zanzibar, Hon. Ambassador Sefu Ali Idi receiving information on the Gliricidia-maize intercropping technology at a demonstration plot in the agricultural exhibition ground in Morogoro in August 2018 (b).

Table 2: Gross Margin and Return to Labor for Maize (MM)-Glirickidia (GS)-pigeonpea (PP) technology at Manyusi Village

Maize-GS-PP Intercropping	2015		2016	
	GM (USD/ha)	RNLB	GM (USD/ha)	RNLB
MMPPGlr	487	11.4	1263	24.0
MMGlr	149	5.20	141	5.00
MMPP	1096	20.4	1715	30.4
MMMM	155	4.40	257	6.20
PPPP	1060	19.2	1669	29.0

Proposals for the future

- Evaluate drought resilience and trade-offs of the double up technology in semiarid.
- Assess soil health and mitigation co-benefits of the doubled up legume, which are just being realized.
- Capacity building and strengthening partnerships with national partners to supporting wider scaling of the technology

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